

STATUS REPORT ON AN UNUSUAL PLASTIC ITEM FOUND ON SANDSIDE BEACH ON 15TH DECEMBER 2006

1. Introduction

During a routine survey at Sandside beach on the 15th December 2006 at approximately 1335, the alarms on the beach survey vehicle were triggered by a plastic-like item (Figure 1). It was found towards the eastern end of the beach, lying in seaweed close to the water's edge at coordinates 296726, 965472. Mr Minter from Sandside estate was contacted and his representative, Mr W. McIvor attended the scene. The radioactive contaminant which triggered the alarm was confirmed as ¹³⁷Cs using a handheld spectrometer. The item along with entangled flotsam such as seaweed was recovered to Dounreay, where it was analysed by UKAEA chemistry support services (CSS).

2. Results

2.1 Field monitoring

Initial readings by Health Physics (HP) surveyors using an EP15 probe were 50cps beta gamma. The item was retrieved from the sand surface by the team and further dose rate measurements were taken by an RO2 instrument which gave 12 µSv/hr beta/gamma and 2 µSv/hr gamma.

2.2 Laboratory measurements

At the labs the item underwent further analyses, including gamma spectroscopy and contamination and dose rate measurements.

Sample reference	¹³⁷ Cs result or LOD	⁶⁰ Co result or LOD	⁹⁴ Nb result or LOD
SS/06/19	4.6E+03	<2.4E-01	<1.8E-01

Table 1. Gamma spectroscopy results (Bq). Results qualitative only due to non-standard geometry.

To check for homogeneity of the contamination, a handheld probe was moved slowly across the item. The highest counts came from the middle of the item (400cps beta) with a radiation level of 11 µSv/hr at contact & <2 µSv/hr at 10cm measured by RO2 meter. It is therefore likely that the contamination is localized and could be a point source. The mini monitor measuring the beta count was an EP 15L which has a higher efficiency for ¹³⁷Cs than the field instrument.

A selection of photographs of the item are shown in Figures 1, 2, 3 and 4. The main bulk of the item is black in colour and appears to have been melted and deformed, perhaps due to fire or being near some other heat source. In the area near the centre of the bulk item can be seen a whitish item at the top of which is a small black rubber-like cap (Figure 2) which was removed for closer examination (Figure 3). It is not clear if this whitish item was originally part of the bulk material or has subsequently become fused to it. The cap was able to be stretched during removal and appears to have been deliberately shaped with a bevelled appearance and is ridged near the middle. Removal of this cap revealed a flange-like end to the whitish material (Figure 4). The beta count rates were largely confined to this area of the bulk

material where the whitish item was located. The ^{137}Cs contamination could be associated with it, or could be associated with a particle trapped in the bulk black material, or associated with the part of the black material itself. Photographs have been circulated within UKAEA Dounreay in an attempt to recognize what the whitish item might be, on the assumption that it has originated from somewhere on site.

A pair of pointed tweezers were applied to the bulk material; it could be penetrated but only with considerable pressure. The whitish material was more flexible.

No part of the item reacted to the passing of a magnet over it.

Measurements were made of the weight and dimensions of the item and are shown in Table 2.

Sample reference	Weight (g)	Length (mm)	Width (mm)	Height (mm)
SS/06/19	153	190	45	90

Table 2. Approximate weight and dimensions of item.

The bulk item was placed in a dish of water to see if it was buoyant. The item sank. From a measurement of the amount of water which was displaced, the density of the bulk item was assessed as close to 1.0.

Care was taken to retrieve particulate material which was released into the water phase. This material was retrieved and combined to form a sample for gamma spectrometry. The water used in the flotation test was also counted by gamma spectrometry. The rubber-like cap was also counted. The results of these measurements are shown in Table 3.

Sample	Weight (g)	^{137}Cs (Bq/g)	^{137}Cs (Bq)
Rubber cap	-	-	51
Loose particulate material	0.843	689	581
Test water	-	-	ND

Table 3. Gamma spectrometry results for additional samples. Result for rubber cap is qualitative due to non-standard geometry. ND = not detected.

To a first approximation, the amount of ^{137}Cs on the cap and in the loose material accounts for about 15% of the total ^{137}Cs estimated on the whole sample – see Table 1.

After sawing a small piece from one end of the bulk item, the internal structure was examined visually. The newly exposed faces were solid and black with no notable structure or voids.

Small pieces of material were removed from the black bulk material and from the flexible whitish material within it for analysis by EDAX and XRD.

EDAX results from the white material show the most abundant element to be carbon with significant amounts of oxygen. Examining three different spots on the sample gave the percentage weight of

carbon to be between 75 and 80% and the percentage weight of oxygen to be between 15 and 20%. Some other trace elements were present which are consistent with sea water - these include sodium, chlorine, aluminium, phosphorus, calcium, potassium, sulphur. The black material gave broadly similar results although with a wider range of 60-85% for carbon and 12-25% for oxygen. One spot also showed 9% nitrogen. Similar trace elements were also found. These results are consistent with the materials being some form of plastic.

XRD results were not conclusive for either sample. In both cases the potential matches being suggested are all long chain hydrocarbons but there are no exact matches. We are not confident with these to suggest anything more specific than long chain hydrocarbons. Hydrocarbons do tie in with the predominantly carbon elemental breakdowns from EDAX.

Further work to identify the plastics present, if desired, would need to be carried out by a specialist external laboratory.

Joe Toole
Land Remediation and Particles
5th January 2007



Figure 1. Item retrieved from Sandside beach on 15th December 2006.



Figure 2. Close up of whitish item near middle of bulk material. Rubber-like cap is visible behind the white material.

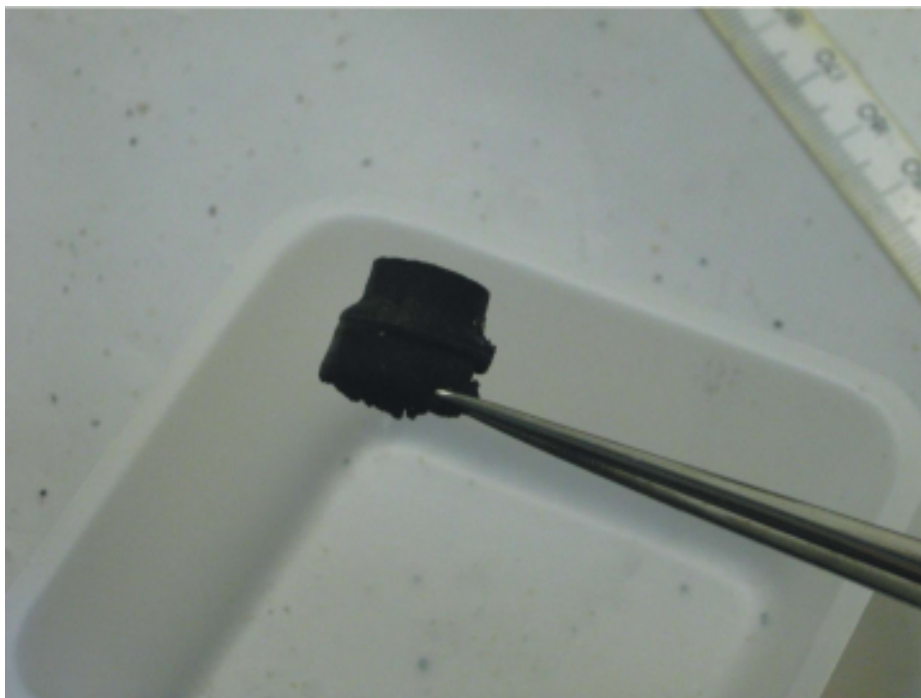


Figure 3. Rubber-like cap after removal from whitish item.



Figure 4. Close up of whitish item after removal of cap.